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THESIS

THE POTENTIAL COST SAVINGS OF ESTABLISHING A MARINE CORPS EXERCISE SUPPORT DETACHMENT IN YUMA, AZ

by

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March 2014

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13. ABSTRACT (maximum 200 words)

This thesis analyzed the potential cost savings of establishing an Exercise Support Detachment (ESD) in Yuma, AZ. It compared the costs of the current operations (status quo) to those associated with an ESD (proposed alternative). The costs of the status quo were calculated using historical data. A large cost of the status quo is the personnel cost associated with equipment preparation and embarkation, and post-exercise maintenance. The level of personnel involved differs from unit to unit. Therefore, the costs of the status quo were calculated using three different personnel levels of involvement assumptions: 10%, 20%, and 30%. The costs of the proposed alternative were calculated using historical data from similar projects and operations as well as DoD and U.S. government regulations regarding cost estimation. The annual costs of the alternative were subtracted from the annual costs of the status quo to quantify the annual savings at each level of involvement. The annual savings were then analyzed using the net present value (NPV) method to show the total value of the ESD over a 50-year period.

The analysis revealed an annual savings of $4.9 million, $13.9 million, and $22.4 million at the 10%, 20% and 30% levels of involvement, respectively. The NPV ranged from $108 million to $558 million, assuming a 50-year lifespan of the ESD buildings. A sensitivity analysis was conducted using a 10-year building lifespan, which changed the NPV range to $25.7 million to $182.8 million. Overall, the establishment of an ESD in Yuma, AZ, has the potential to save the U.S. government significant money.

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THE POTENTIAL COST SAVINGS OF ESTABLISHING A MARINE CORPS EXERCISE SUPPORT DETACHMENT IN YUMA, AZ

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LIST OF ACRONYMS AND ABBREVIATIONS

DoD	Department of Defense
WTI	Weapons and Tactics Instructors Course
MAWTS-1	Marine Aviation Weapons and Tactics Squadron One
ESD	Exercise Support Detachment
MCAS	Marine Corps Air Station
MAWTUPac	Marine Air Weapons Training Unit Pacific
MAWTULan	Marine Air Weapons Training Unit Atlantic
MRX	Mission Rehearsal Exercise
MACG	Marine Air Control Group
VMAQ	Marine Tactical Electronic Warfare Squadron
FY	fiscal year
O&M	operations and maintenance
MAW	Marine Aircraft Wing
NAF	Naval Airfield
NPV	net present value
CF	cash flow
OMB	Office of Management and Budget
MSC	Major Subordinate Command
T/O	table of organization
MCO	Marine Corps Order
OpFor	operating forces
TAD	Temporary Additional Duty
ADVON	advance party
MAGTFTC	Marine Air Ground Task Force Training Command
MCAGCC	Marine Corps Air Ground Combat Center
GS	general schedule
OPM	Office of Personnel Management
MILCON	Military Construction
MAGTF	Marine Air-Ground Task Force
ACE	Air Combat Element

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I. INTRODUCTION

A. BACKGROUND

Weapons and Tactics Instructors Course (WTI) is an integral part of Marine aviation training. Marine Aviation Weapons and Tactics Squadron One (MAWTS-1) conducts two WTI courses per year, one in the spring and one in the fall. These courses produce more than 300 graduates annually. WTI provides the Marine Corps with highly trained officers in the aviation community.

A key component of the WTI course is the fully integrated combined arms exercise, which requires significant support from the operation forces. Operating forces deploy detachments to Yuma, AZ, for six to eight weeks in the support of the exercise. These detachments provide MAWTS-1 with field units to use during the WTI course. To adequately support the exercise, the detachments require large amounts of equipment from the home bases or stations. The transportation costs associated with the detachments' equipment amount to more than a million dollars per year for the Marine Corps.

The Marine Corps Air Ground Combat Center in Twentynine Palms, CA, had a similar issue but found a different approach to conduct operations that saves money. An Exercise Support Detachment (ESD) was established in Twentynine Palms, CA, to provide and maintain equipment in support of exercises and eliminate the need for units to ship equipment, thus reducing the cost of transportation. Units "borrow" equipment from the ESD for the exercise and return it at the end of the exercise.

This thesis compares the costs of the current operations (the status quo) of the WTI course in Yuma, AZ, to the costs of operating an exercise support detachment (the alternative) in order to identify potential cost savings.

1. Marine Corps Air Station Yuma

The illustrious history of Marine Corps Air Station (MCAS) Yuma goes back to 1928, when Col. Benjamin F. Fly persuaded the United States government to lease land

from Yuma County and establish an airfield (MCAS Yuma, 1997). The airfield was used occasionally until 1941, when the federal government approved the construction of permanent runways. During World War II, the government authorized the construction of an air base, which became one of the most active military pilot training centers in the country. Following World War II, the air base ceased flight operations and other government agencies used the base for a headquarters to direct irrigation projects in the area.

The United States Air Force reactivated the base on July 7, 1951, as a training facility for elements of the Western Air Defense Forces. On January 1, 1959, the Air Force transferred the facility to the Navy, which then designated it as the Marine Corps Auxiliary Air Station. It became Marine Corps Air Station Yuma on July 20, 1962. Since then, it has served as a training facility for Marine Corps aviation units.

2. Marine Aviation Weapons and Tactics Instructor Squadron One

Commissioned on June 1, 1978 by the Commandant of the Marine Corps, Marine Aviation Weapons and Tactics Instructor Squadron One (MAWTS-1) is "staffed by individuals of superior aeronautical and tactical expertise, instructional abilities, and professionalism" (MAWTS-1, 1995). MAWTS-1 provides graduate-level instruction through its WTI course, which produces over 300 graduates annually. The graduates serve in "training billets in every tactical unit in Marine Corps aviation" (MAWTS-1, 1995) and provide these units with "tactical and weapons systems employment" (MAWTS-1, 1995) expertise.

3. Weapons and Tactics Instructors Course

WTI is an integral part of Marine aviation training. According to the WTI 2–13 Planning Guide (2012), "The purpose of WTI is to produce Weapons and Tactics Instructors from qualified candidates from the various Marine Corps communities" (p. 3–1). It provides the Marine Corps with highly trained officers in the aviation community.

WTI courses began in 1976, originally conducted separately by Marine Air Weapons Training Unit Pacific (MAWTUPac) and Marine Air Weapons Training Unit

Atlantic (MAWTULant). In 1977, the Marine Corps combined the courses at MCAS Yuma, where instructors and staff from both MAWTUPac and MAWTULant combined to offer instruction to students. Due to the success of the combined courses, the Commandant of the Marine Corps commissioned MAWTS-1 and thus began the WTI course we know today. Components of the course changed over the years, but the fundamental elements remained consistent. According to MAWTS-1 (1995):

> The WTI Course is a fully integrated course of instruction for highly experienced and fully qualified officers from all aviation communities. Officers from ground combat, combat support, and combat service support also attend the course to ensure appropriate air-ground interface. The WTI course academic syllabus allows the WTI candidate to put classroom lessons to work in the air. Briefing and debriefing techniques and airborne instructional skills are reviewed and tactics and weapons systems employment are evaluated. The course culminates in a fully integrated combined arms exercise encompassing all functions of Marine Corps aviation in support of a national Marine Air Ground Task Force. (para. 4)

The fully integrated, combined-arms exercise is a key component to the WTI course because it provides hands-on, realistic training for the students, which cannot be reproduced through simulation. "This complex exercise requires significant support and staff augmentation from the operating forces" (MAWTS-1, 2012, p. 3–1). Operating forces deploy to Yuma, AZ, for six to eight weeks in support of the exercise and provide MAWTS-1 with field units to use during the WTI course.

WTI also serves a purpose for the supporting units as well. The WTI 2–13 Planning Guide (2012) states that "WTI can serve as a venue for the conduct of a Mission Rehearsal Exercise (MRX) for MACG and VMAQ units scheduled to deploy" (p. 3–3). The MRX is an important part of Marine Corps pre-deployment training because it helps ensure units are combat proficient and ready to perform during deployment.

4. Department of Defense Budget

Effective with the 2013 fiscal year, the fiscal environment in which the Department of Defense (DoD) operates is challenging. Many Congressional leaders are looking to save money by making cuts in the DoD budget. The largest Congressional Act to affect the DoD is Budget Sequestration.

According to the White House website, "In 2011, Congress passed a law saying that if they couldn't agree on a plan to reduce our deficit by $4 trillion—including the $2.5 trillion in deficit reduction lawmakers in both parties have already accomplished over the last few years—about $1 trillion in automatic, arbitrary and across the board budget cuts would start to take effect in 2013." Sequestration began on March 1, 2013, due to lack of congressional action. The automatic cuts mean the DoD will be trying to maintain its current capabilities on a reduced budget.

Due to sequestration and the lack of adequate funding, the DoD is looking to reduce costs in every facet of its operations. Inefficient programs and wasteful spending are two areas high on the list for reduction or elimination. According to the Fiscal Year 2012 Department of Defense Efficiency Initiatives, the DoD found ways to trim $10,741,000,000 from the 2012 budget and $100,173,000,000 over a five-year period (FY2012–FY2026). All departments of the DoD need to analyze their programs and operations in order to identify ways to decrease cost and improve efficiency. Analyzing current operations and developing strategies to reduce costs allows leaders to increase the sustainability of the programs in austere fiscal environments.

B. PURPOSE

The purpose of this thesis is to examine the potential cost savings associated with establishing an Exercise Support Detachment in Yuma, AZ, in order to provide a quantitative assessment of the proposed option and compare that to the status quo. The results of this thesis show the potential savings of operations and maintenance (O&M) funds, as well as the amount of time required to recover the initial investment. This thesis provides a key input for discussion regarding the establishment of an ESD at MCAS Yuma.

While this thesis provides a quantitative cost analysis and an estimation of the cost savings associated with an ESD, it is not meant to be the only information used to determine the effectiveness of an ESD. Many other benefits and tradeoffs should be considered. Such benefits include the flexibility provided by an ESD, the increased capacity for operations at Yuma, opportunities for other training exercises, and the impact

of increased jobs at MCAS Yuma. Tradeoffs requiring consideration include fewer operations and training opportunities for Marine Aircraft Wing (MAW) logisticians and maintenance personnel, impact of more equipment to MCAS Yuma, and the impact to units of not using their own equipment.

C. RESEARCH QUESTIONS/SCOPE

Both the primary and secondary research questions deal with biannual costs due to the cyclical nature of operations in Yuma. Costs one year will be lower/higher than the costs next year depending on which units are supporting the WTI exercises. When units from the East Coast support the exercise, the costs increase compared to when units from the West Coast support the exercises. Over a two-year period, the cycle will look similar to what is depicted in Table 1.

Exercise	Percent of Support Provided
Year 1,WTI Exercise # 1	100% East Coast, 0% West Coast
Year 1,WTI Exercise # 2	50% East Coast, 50% West Coast
Year 2,WTI Exercise # 1	0% East Coast, 100% West Coast
Year 2,WTI Exercise # 2	50% East Coast, 50% West Coast

Table 1 Sample WTI Exercise Support over a Two-year Period

The exact percentages may change slightly depending on the year, but this is the general cycle of WTI exercises, which have a large impact on transportation costs. Therefore, this research evaluated biannual costs to accurately quantify costs and savings.

1. Primary Research Question

The primary research question is:

1) What cost savings are associated with establishing a Marine Corps Exercise Support Detachment in Yuma, AZ?

2. Secondary Research Questions

The secondary research questions are:

1) What are the current biannual relevant costs associated with field support units at the Weapons and Tactics Instructors Course that require operations and maintenance funding?

2) What are biannual relevant costs associated with field support units operations and maintenance funding if an Exercise Support Detachment is established?

3) What would be the initial investment in facilities made by the Marine Corps?

4) How long would it take for the United States Marine Corps to recover the initial investment in facilities, given the annual cost savings?

II. LITERATURE REVIEW

A. FISCAL SITUATION

The current fiscal situation of the United States government is austere, to say the least. After more the 10 years of war, and years of a difficult economy, the national debt has risen from $5.674 trillion in 2000 to $16.066 trillion in 2012 (Department of the Treasury, 2013). The U.S. government is looking for ways to decrease the annual deficit, balance the budget, and eventually reduce the national debt. The largest portion of discretionary funds goes to the Department of Defense (DoD), and many plans to balance the budget call for deep cuts in the DoD budget. On March 1, 2013, the U. S. government implemented sequestration, which meant "about $1 trillion in automatic, arbitrary and across the board budget cuts" (The White House, 2013). Sequestration reduced the DoD budget by 9.4% (Pellerin, 2012). The 9.4% was taken from the spending levels of FY2012, not the requested FY2013 funds, which meant the impact of the cuts to the FY2013 budget were greater than 9.4%. This occurred because Congress failed to pass a budget and forced the DoD to operate under a continuing resolution. A continuing resolution allows the government to operate in the absence of a budget by allowing agencies and departments to spend at last year's levels. Continuing resolutions do not account for inflation or increases in costs. In response, the DoD began looking for ways to reduce costs and increase efficiencies.

The Office of the Under Secretary of Defense (Comptroller) (2012) published the "More Disciplined Use of Resources" for the FY2013 budget estimate, which outlined the initiatives the department is taking to reduce costs and improve its use of resources in the upcoming years. Many of the initiatives involve reassessing current programs and finding ways to improve their use of resources. The DoD impressed on all commands the need to reassess current programs and operations, and analyze their budgets to find more efficient ways to operate and train in a fiscally constrained environment. There are multiple approaches to analyze current operations. One effective way is to propose an alternative, which is likely to decrease costs, quantify the costs of the proposed

alternative, and compare those costs to the current operations. Maj. Aaron R. Hinman's (2011) thesis at the Naval Postgraduate School is a great example of this.

B. HINMAN THESIS

In his thesis, *Analysis of the Potential Efficiencies Gained from a Permanent Maintenance Detachment at NAF El Centro, California*, Hinman (2011) examined the current operations of Training Air Wing Two and compared the costs of those operations to a proposed alternative he believed would save the Navy money. The goal was to identify how much money the Navy would save by implementing the purposed alternative and provide Navy leadership with quantifiable figures on which to base their decisions.

Hinman (2011) quantified the relevant costs of the current operations (status quo) as well as the costs of the proposed alternative (a permanent maintenance detachment) and compared them. Hinman (2011) estimated costs of the alternative by looking at similar programs and operations within the DoD and scaling the costs to match the scope of the proposed alternative. While data showed the annual cost of the alternative to be higher, his research noted a 16.7 percent cost savings per completed student event, meaning the alternative could handle a larger capacity and be more efficient.

Hinman's (2011) approach to compare the costs of a current operation to those of a proposed and, more importantly, feasible alternative provided a framework to assess our current operations and found more efficient methods to maintain the same level productivity. This approach is in line with the DoD initiatives to cut costs and improve the efficiency of the United States Military.

C. COST ANALYSIS CONCEPTS

1. Net Present Value

Capital investment (also known as capital budgeting) decisions are usually long term (greater than one year) investments and involve spending money now to receive money in the future. This includes purchasing equipment, land, technology, or deciding whether to buy or lease items. It also includes investing money in the bank or stock

market. Many factors will influence the decision of whether or not to invest in something, but it usually comes down to how much money the investment will make (or save). Since these investments are usually longer than one year and can span many years, it is difficult to evaluate exactly how much money an investment will make. One of the biggest, and arguably most important, factors in capital budgeting is the time value of money.

Money loses value over time. A dollar today is not worth a dollar a year from now since you could invest that dollar (even in a savings account) and you would gain interest. According to Garrison, Noreen, and Brewer (2012), "projects that promise earlier returns are preferable to hose that promise later returns." Capital investment decisions usually require a large initial investment of money followed by returns in later years. However, due to the time value of money, the nominal value of the initial investment cannot be directly compared to the nominal value of the returns since they occur in different years. Therefore, the cash flows in later years must be discounted. There are two approaches to do so: the net present value method (NPV) and the internal rate of return (IRR) (Garrison, 2012).

The NPV method compares the present value of the project's cash outflows to the present value of the projects cash inflows and the difference is called the NPV (Garrison, 2012). NPV discounts the value of money over time by using a discount factor. This allows future cash flows to be compared to current outflows. The discount rate is usually a company's cost of capital or a predetermined required rate of return the company expects to receive from its investments. "The cost of capital is the average rate of return the company must pay to its long-term creditors and shareholders" (Garrison, 2012). Therefore, if the NPV is positive, the investment will return more than the required rate of return (discount rate). Unless there are extenuating circumstances, an investment with a negative NPV should not be undertaken.

The formula for the NPV method is:

$$NPV = \sum_{t=0}^{T} \frac{CF_t}{(1+i)^t}$$

CF is the net cash flow for a given year. This can be positive or negative depending on the conditions of the investment. Usually the first CF or first few CFs are negative since money is being invested. The discount rate, i, is the company's cost of capital or a required rate of return as discussed above. The number of years from the beginning, t, show how many years have passed since the investment. The original investment is usually not discounted since it is made at the very beginning and no time has passed. The total number of periods, T, stands for the total number of years the investment is predicted to last.

For example, a company invests $10,000 in a machine that will produce additional annual cash flows of $3,000. The machine will last 5 years and the company's required rate of return (discount rate) is 5%. The NPV formula would look like this:

$$NPV = -\$10,000 + \frac{3,000}{(1+.05)^1} + \frac{3,000}{(1+.05)^2} + \frac{3,000}{(1+.05)^3} + \frac{3,000}{(1+.05)^4} + \frac{3,000}{(1+.05)^1} = \$2,350.58$$

The original investment of $10,000 is not discounted since it is made in the beginning. The NPV for the example is $2,350.58, which means the investment would return more than the company's required rate of return.

Government agencies follow guidance from the Office of Management and Budget (OMB) set forth in Circular No. A-94. OMB published the revised edition on October 29, 1992. The document states:

> The standard criterion for deciding whether a government program can be justified on economic principles is net present value -- the discounted monetized value of expected net benefits (i.e., benefits minus costs). Net present value is computed by assigning monetary values to benefits and costs, discounting future benefits and costs using an appropriate discount rate, and subtracting the sum total of discounted costs from the sum total of discounted benefits. Discounting benefits and costs transforms gains and losses occurring in different time periods to a common unit of measurement. Programs with positive net present value increase social resources and are generally preferred. Programs with negative net present value should generally be avoided. (p. 4)

Appendix C of the circular, updated annually by OMB, identifies the discount rates government agencies will use when conducting a NPV analysis regarding cost-

effectiveness, lease purchase, and related analyses. OMB assigns rates for different periods of time (3-year, 5-year, 7-year, 10-year, 20-year, and 30-year). The rate used in the NPV calculation depends on the expected duration of the investment. For investments periods that do not match the periods outlined by OMB, a "linear interpolation" should be used. "For example, a four-year project can be evaluated with a rate equal to the average of the three-year and five-year rates" (OMB 2013). OMB directs that "programs with durations longer than 30 years may use the 30-year interest rate" (OMB, 2013).

2. Opportunity Cost

Garrison, Norren, and Brewer (2012) define opportunity cost as "the potential benefit that is given up when one alternative is selected over another." In economics, the opportunity cost is associated with the most profitable forgone alternative. For example, if a person is trying to decide between attending college and working, the opportunity cost of going to college is the wage of the job the person foregoes. The total cost of college must include the foregone wages, not just the money paid to attend college. If a person can earn $25,000 annually without a college education and the cost of college is $50,000 annually, the opportunity cost of college is $25,000 and the total cost of college is $75,000. Most accountants and people do not track opportunity costs, but "they are costs that must be explicitly considered in every decision" (Garrison, 2012, p. 46). Opportunity costs may not be included on a company's budget sheet, but can be substantial enough to change a decision.

For example, if a company is choosing between producing widget A at a cost of $10,000 annually or buying widget A from another vender for a cost of $12,000 annually, the decision would be to produce widget A because it is cheaper. However, if widget B could be produce on the same assembly line as widget A and sold for $10,000 annually, the decision would be different. The revenue from sales of widget B is the opportunity cost in this example.

3. Relevant Costs

People make decisions every day. Whether in our personal lives or professional lives, everyone makes decisions. "Every decision involves choosing from among at least

two alternatives" (Garrison, Noreen, & Brewer, 2012). When evaluating decisions, the cost and benefits of one choice must be compared to those of the other choices. However, not all costs and benefits should be included in the calculation and decision making process.

Differential analysis focuses on the cost and benefits that differ among the alternatives. The costs and benefits that differ are considered relevant costs or benefits. If a cost or benefit will be the same no matter which alternative is selected, it should be disregarded. This allows managers to focus on the relevant costs and benefits that determine which alternative is better. "The key to successful decision making is to focus on just these relevant costs and benefits and to ignore everything else—including the sunk costs and future costs and benefits that do not differ between the alternatives" (Garrison, 2012, p. 529)

Relevant costs will differ in every situation. What is relevant between alternatives A and B, may not be relevant between alternatives B and C. To evaluate two alternatives, managers must first properly identify the relevant costs between the two. For example, if an employee is salaried, meaning he/she gets paid a set amount no matter what duty he/she performs, the wage is not a relevant cost. However, as previously discussed, there is an opportunity cost which is relevant. Managers must take their time in identifying and evaluating relevant costs since they are the basis for the evaluation. Correctly identifying the relevant costs will save time in the future and allow for a better comparison between two alternatives.

4. Sensitivity Analysis

The NPV method makes certain assumptions regarding some inputs. Many times prices of resources are assumed at a certain level; however, prices are not always stable. This makes NPV analysis open to risk and can skew findings. Accounting for risk in a NPV analysis makes the results stronger and can provide better information for decision-making.

One way to account for risk is by conducting a sensitivity analysis. A sensitivity analysis is "the calculating procedure used for prediction of effect of changes of input

data on output results of one model" (Jonvanovic, 1999, p. 218). It uses a range of values of inputs (i.e., different prices) to determine at what point the predicted value of the investment becomes negative. The analysis strives to find the minimum (or maximum) values each input can take, giving a range of possible values of inputs that still make the investment worthwhile. It provides decision makers with a better understanding of an investment's risk.

D. SUMMARY

This chapter covers the reasons and a possible framework for the analysis, as well as the relevant concepts and terminology used in the analysis. The current fiscal situation dictates that the DoD find ways to reduce costs while maintaining the current level of operations. Hinman's thesis provides a framework on which to model the methodology. This research draws from important cost-analysis concepts, which form the basis for this research and provide the framework to analyze the given situation. It is important to understand these concepts to follow the research and analysis presented. The next chapter incorporates the framework and concepts discussed in this chapter, and introduces the methodology for this research.

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III. METHODOLOGY

A. OVERVIEW

The methodology section covers how the costs of the status quo and the alternative were calculated. Effective comparison of the two situations required consideration of only relevant costs. Again, relevant costs are defined as those costs that would differ between the two alternatives. Historical data provided the basis for the calculations of the costs associated with the status quo. Cost estimation based on similar activities was used to calculate the cost of the alternative.

The scope of this thesis required following certain assumptions pertaining to current operations associated with the status quo and the proposed alternative due to the variability of operations existing among different units at different times. Current and accepted practices formed the foundation for the assumptions. The following sections identify and explain the assumptions in detail.

B. STATUS QUO

1. Transportation Costs

For the WTI exercise, the Marine Corps sends equipment from both coasts to support the exercise. The Marine Corps employs contracted tractor-trailers to transport the equipment across the country. The prices for each contractor differ depending on the location and the contract used to hire the contractor. These costs make up a large portion of the expenses associated with the current operations held in Yuma, AZ.

Major subordinate commands (MSCs) pay for the transportation using their O&M funds and track these costs. This research used available historical data to quantify the costs associated with the transportation of equipment to Yuma, AZ. However, a disparity existed among the MSCs cost-tracking procedures, and some information was missing. For missing data, the lowest costs of similar contracts were used to capture cost.

2. Cost of Time—Equipment Preparation and Embarkation Phase

Marines spend a great deal of time prior to an exercise preparing equipment for embarkation. The time spent and the personnel involved vary greatly depending on the unit and the leadership of the unit. A reasonable assumption of preparation time is four weeks (28 days) prior to the beginning of the exercise. This is the amount of time used for the equipment preparation and embarkation timeline. Four weeks allows for two weeks of preparation and two weeks for the actual transportation of equipment. The transportation time is included because the unit will be without their equipment, which means they cannot use that time to train, creating an opportunity cost of time while the equipment is in transit.

The other key to calculating the cost of time associated with equipment preparation and embarkation is the amount of personnel involved. The amount of personnel involved varies from unit to unit and situation to situation. The table of organization (T/O) is a basis for personnel assigned to a unit. Most units do not have a full T/O and not all Marines are involved in equipment preparation and embarkation. However, per Marine Corps Order (MCO) 5320.12H (United States Marine Corps, 2012), the Commandant of the Marine Corps (CMC) set a "minimum manning level "red-line" of 95% for the operating forces (OpFor) units, which are listed in Enclosure 2 of the aforementioned MCO. This means the units involved in WTI will have at least 95% of their T/O. Reserve units supporting WTI may not have a full T/O but are still required to provide the same support as an OpFor unit and have the same number of personnel involved.

The WTI 2–13 Planning Guide (Conference Results) identifies the units required by MAWTS-1 to support WTI. However, individual units still maintain control over the number of personnel involved and deployed in support of WTI. Given the potential unpredictability associated with personnel numbers, it was pertinent to establish levels of personnel involvement to objectively quantify the number of personnel. Therefore, this research assumed three different levels of personnel involvement: 10%, 20%, and 30%. The 95% manning level and the three levels of personnel involvement resulted in the following personnel numbers in Table 2 and were used in the cost calculations:

	MACG 28			1/6			1/10			MWSS 372		
Grade	10%	20%	30%	10%	20%	30%	10%	20%	30%	10%	20%	30%
O4	3	6	9	0	0	0	0	0	0	0	0	1
O3	6	14	21	1	3	4	0	0	0	0	2	3
O2	5	11	16	2	5	8	0	2	3	0	1	2
O1	0	0	0	0	0	0	0	0	0	0	0	0
W5	0	0	0	0	0	0	0	0	0	0	0	0
W4	0	0	0	0	0	0	0	0	0	0	0	0
W3	0	1	1	0	0	0	0	0	0	0	0	0
W2	1	2	3	0	0	0	0	0	0	0	1	2
W1	0	0	0	0	0	0	0	0	0	0	0	0
E9	1	3	4	0	0	0	0	0	0	0	0	0
E8	3	7	11	0	1	2	0	0	0	1	2	3
E7	10	21	32	1	3	4	0	0	1	2	4	6
E6	13	27	41	3	7	10	1	2	4	4	8	13
E5	34	72	108	9	20	30	4	8	13	11	23	35
E4	46	97	146	21	45	68	8	17	25	16	33	50
E3	58	124	186	31	65	98	4	9	13	15	32	48
E2	0	1	1	1	2	3	0	0	0	0	1	2
E1	0	0	0	17	36	55	6	13	19	0	0	0
Total	180	387	581	86	187	282	23	51	78	49	107	165

Note 1: Acronyms

- MACG 28–Marine Air Control Group 28 (Air Control and Communications Unit)
- 1/6–1st Battalion, 6th Marines (Infantry Battalion)
- 1/10–1st Battalion, 10th Marines(Artillery Battalion)
- MWSS 372–Marine Wing Support Squadron 372 (Logistics Support Unit)

Note 2: Numbers calculated using FY2013 T/Os

Table 2 Number of Military Personnel Involved in WTI Operations

The DoD defined the military standard pay and reimbursement rates for FY2013 for each rank in the FY2013 (DoD) military personnel composite standard pay and reimbursement rates memorandum. This cost is then multiplied by daily rate of 0.00439, per the deputy comptroller (2012). Table 3 shows the annual and daily compensation rates of military personnel by pay grade.

Pay Grade	Annual Compensation	Daily Compensation
O - 4	$ 164,812	$ 723
O - 3	$ 138,563	$ 608
O - 2	$ 109,828	$ 482
O - 1	$ 82,056	$ 360
WO - 3	$ 137,667	$ 604
WO - 2	$ 121,662	$ 534
WO - 1	$ 110,497	$ 485
E - 8	$ 115,976	$ 509
E - 7	$ 103,983	$ 456
E - 6	$ 90,139	$ 395
E - 5	$ 73,307	$ 321
E - 4	$ 60,214	$ 264
E - 3	$ 51,069	$ 224
E - 2	$ 45,373	$ 199
E - 1	$ 41,804	$ 183
Note 1: Pay grades O–5 through O–10, WO–4 and WO–5, and E–9 assumed by this research to not participate in the equipment preparation and embarkation phase.		

Table 3 Annual and Daily Compensation Rates for Military Personnel

3. Cost of Time—Post-exercise Equipment Maintenance Phase

WTI takes a toll on equipment. The hot, sandy conditions of the Yuma desert increase the wear and tear on equipment and degrade the operational capability of the equipment. Units must repair the equipment quickly following the exercise in order to bring all equipment to a full-mission-capable status. The time spent repairing equipment varies depending on the unit and the type of equipment repaired. Most units execute a two-week maintenance stand-down in order to repair a majority of the degraded equipment. A maintenance stand-down means the focus of the unit's operations is repairing and maintaining equipment.

The research assumed a two-week (10 days) timeline to calculate the costs of time in the post-exercise equipment maintenance phase and based the personnel numbers on Table 2 and costs on Table 3. Most likely, the time associated with post-exercise equipment maintenance exceeds two weeks due to the amount of equipment requiring repairs and the availability of parts. The assumptions made minimize the opportunity

costs of time in this phase. If the actual time spent repairing and maintaining equipment after the exercise were tracked and used in the calculation, the cost may likely be higher.

4. Cost of Repair and Replacement Parts

The actual operations conducted are the same; therefore, one can expect the same wear and tear on the equipment. Given this, the cost of repair and replacement parts are the same in both situations. The consolidation of maintenance activities in the alternative may actually reduce the cost of repair and replacement parts due to economies of scale. However, to be conservative, it is assumed the costs are the same and therefore not relevant.

5. Temporary Additional Duty (TAD) Costs

Temporary Additional Duty (TAD) orders encompass a broad range of operations and training events. Commands assign Marines TAD orders when Marines are assigned to another unit for a temporary period and are expected to return to the unit. While under TAD orders, Marines are authorized a certain amount of money for traveling expenses such as lodging and food. These expenses are considered TAD costs.

TAD costs associated with supporting units for WTI are usually for the advance party (ADVON) and the rear party. The ADVON is a small number of personnel that deploy to Yuma before the rest of the unit arrives. The ADVON is responsible for coordinating all activities for the arrival of the rest of the unit and receiving all equipment shipped from the unit's home station. The ADVON usually deploys at least ten days prior to the rest of the unit arriving, and receives TAD authorizations only for those ten days.

The rear party is responsible for ensuring that all personnel and equipment depart Yuma successfully. The rear party usually remains in Yuma for three days after the rest of the unit departs and is authorized TAD money for those three days.

The personnel on the ADVON and rear party are usually the same and vary from unit to unit. This research assumes the ADVON and rear parties consist of a captain, a lieutenant, a gunnery sergeant, a staff sergeant, two sergeants, four corporals, and 12 lance corporals. The money authorized for each rank differs and is based on DoD orders

and regulations. The TAD cost calculation used the maximum per diem rate, per the Defense Travel Management Office, for Yuma County, Arizona, which is $124 per day per person. Given the schedule above, every Marine receives per diem for seventeen days. Table 4 shows the TAD costs associated with the status quo.

Grade	Number of Given Grade	Days ADVON	Days Rear	Total Days TAD	TAD Cost/Day	TAD Cost
O - 3	1	10	3	13	$ 124	$ 1,612
O - 2	1	10	3	13	$ 124	$ 1,612
E - 7	1	10	3	13	$ 124	$ 1,612
E - 6	1	10	3	13	$ 124	$ 1,612
E - 5	2	10	3	13	$ 124	$ 3,224
E - 4	4	10	3	13	$ 124	$ 6,448
E - 3	8	10	3	13	$ 124	$ 12,896
Total	18				Total	$ 29,016

Table 4 TAD Costs Associated with Status Quo

C. PROPOSED ALTERNATIVE

1. Permanent Personnel (Military and Civilian)

To calculate the cost of permanent personnel for the ESD in Yuma, a proposed organization and staffing level was created. The number of personnel derived from the proposed organization was then multiplied by the annual cost of military (Table 3) and civilian personnel (see Table 5 in later discussion).

The staffing was derived using information received from the Exercise Support Division, Marine Air Ground Task Force Training Command (MAGTFTC), Marine Corps Air Ground Combat Center (MCAGCC). Based on the information, a ratio of 3:7 (Marines to Civilians) was used to establish the proper staffing of the Exercise Support Detachment in Yuma. Figure 1shows the proposed command structure of the ESD.

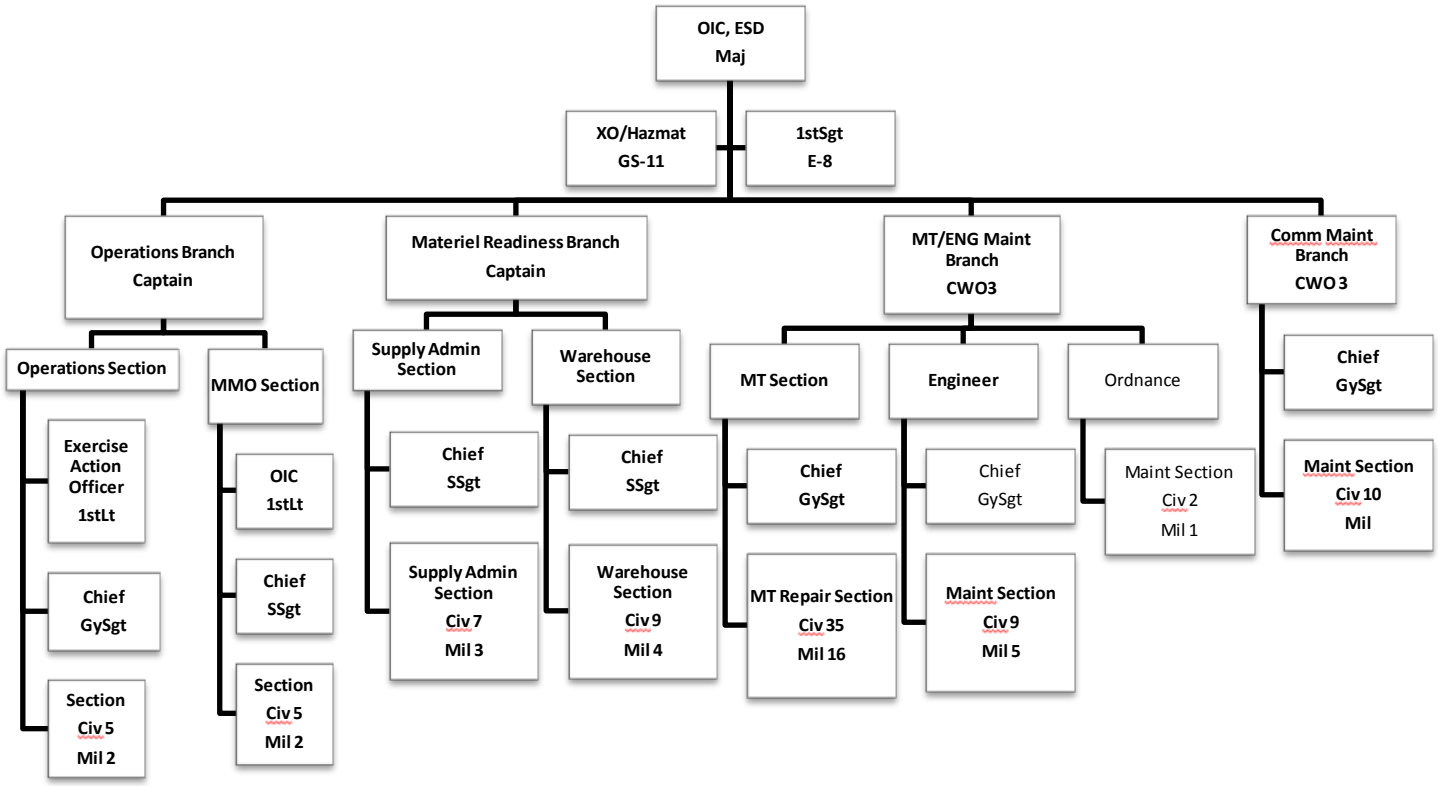

Figure 1 Organizational Chart for the Proposed Alternative (after M. Bruce, personal communication, April, 2, 2013)

The largest factor affecting staffing is the equipment set required to maintain operations. If the equipment set is large and diverse, the ESD will require a large amount of personnel to support all the equipment items.

The organization and hierarchy of the Equipment Support Division, MAGTFTC, MCAGCC influenced the ranks and grades of the personnel proposed for the ESD in Yuma. A similar organization and rank structure allows the unit to function comparably to the Equipment Support Division, MAGTFTC, MCAGCC on which it was based, and should allow the unit to function effectively. Using the Comparison of Military and Civilian Equivalent Grades chart published by the Navy (United States Navy, 2013), the civilian maintenance personnel were given grades in the equivalent to those of their military counterparts, which were assumed to be the pay grade of E - 4.

The calculation of the annual cost of military personnel (see Table 1) is based on the "FY2013 Department of Defense (DoD) Military Personnel Composite Standard Pay and Reimbursement Rates" (Deputy Comptroller, 2012). The cost used to calculate the annual cost of civilian personnel is based on the annual pay rate of general schedule (GS) employees published by the U.S. Office of Personnel Management (OPM, 2013). The calculations only used step 10 amounts (the highest of each pay grade) in order to provide a more conservative estimate of the savings. Table 5 identifies the civilian salaries used in this analysis.

Grade	Step 10
1	$ 26,001
2	$ 29,413
3	$ 33,150
4	$ 37,213
5	$ 41,633
6	$ 46,410
7	$ 51,580
8	$ 57,115
9	$ 63,083
10	$ 69,478
11	$ 76,327
12	$ 91,487
13	$ 108,791
14	$ 128,557
15	$ 151,224

Table 5 Annual Salaries of GS Employees in the Phoenix-Mesa-Scottsdale, AZ, Locality Pay Area

2. Facilities' Costs (Construction and Annual Operating Costs)

The proposed establishment of the ESD requires a large, initial investment in facilities as well as recurring, annual maintenance costs for the facility. Military Construction (MILCON) funding covers the initial costs, and O&M funding pays for the annual maintenance costs. This is important because MILCON and O&M stem from two different Congressional appropriations, and the funding cannot be redistributed between the categories without Congressional approval.

Using the cost of the Exercise Support Division, MAGTFTC, MCAGCC buildings in Twentynine Palms, CA, as a base, this research used the Consumer Price Index (Bureau of Labor Statistics, 2013) to convert the original costs to 2013 dollars, which allows for comparative analysis between the status quo and the alternative. To be conservative, the costs were scaled up to the nearest $100,000. MILCON funds cover these costs.

According to the Federal Real Property Council's 2012 Guidance for Real Property Inventory Reporting (2012), operating costs include "recurring maintenance and

repair costs, utilities (includes plant operation and purchase of energy), cleaning and/or janitorial costs (includes pest control, refuse collection, and disposal to include recycling operations), and roads/grounds expenses (includes grounds maintenance, landscaping, and snow and ice removal from roads, piers, and airfields)" (p.11). According to the most current Federal Real Property Report, published in FY2010, the operating cost per square foot of owned federal buildings was $5.30. Adjusting for inflation, the estimated annual operating cost per square foot is $5.68. The total square footage of the proposed ESD facility is then multiplied by $5.68 to estimate the annual operating expenses of the alternative. O&M funds cover the annual operating costs.

3. Equipment Procurement

Due to the current downsizing of the Marine Corps, the results of the 2012 Force Structure Review Group, and the returning of equipment from Afghanistan, the Marine Corps has equipment assets available to reallocate to different areas, meaning new equipment does not need to be procured. This assumption may underscore the total amount of money saved, but does not affect O&M money saved by the alternative since purchasing equipment uses Procurement funding, a separate appropriations category.

If the Marine Corps wants to forego the impacts to Procurement funds, it can source equipment internally, without facing new procurement costs. This may mean other units would not maintain their full equipment allowance, but the Marine Corps would not spend additional money on the assets. Therefore, the assumption of no procurement costs is a reasonable assumption.

4. Temporary Additional Duty Costs

Although Temporary Additional Duty (TAD) costs exist in both situations, the TAD costs differ between the status quo and the alternative, and thus are a relevant cost. The organization of the ADVON and rear party remains the same as the status quo. For the alternative, the ADVO's responsibilities include inspecting and checking-out equipment from the ESD, which should take a week (seven days). This decreases ADVON time by an estimated seven days, resulting in a cost savings. The rear party still

needs to stay in order to ensure proper return of the equipment to the ESD and all personnel depart from Yuma.

D. NET PRESENT VALUE ANALYSIS

The Marine Corps uses a 50-year lifespan estimate for buildings. Therefore, the NPV analysis assumes a discount rate of 3.0% based on the guidance set forth in OMB Circular 94. The biennial savings calculated for each of the three levels of participation are discounted over a 50-year period and provide the total savings over the estimated life of the alternative.

E. SENSITIVITY ANALYSIS

The sensitivity analysis analyzes different assumptions for the lifespan of a building and their effect on the NPV. The sensitivity analysis changes the lifespan assumptions to 10 years, 15 years, and 20 years to provide an idea of the cost savings that may be realized over a shorter time span. Changing the lifespan assumption changes the discount factors to 2.0, 2.4, and 2.7 respectively. The discount factor for 15-years is not specified by OMB, but is derived from the average of the 10-year and 20-year discount rates per the guidance of OMB (OMB, 2013).

F. SUMMARY

This chapter addresses the relevant costs and assumptions of both the status quo and the proposed alternative, which form the basis for comparison between the status quo and the alternative. The chapter discusses the assumptions for the NPV calculation and why the 30-year rate was selected. It also covers the focus of the sensitivity analysis and the assumptions it analyzes. The next chapter analyzes these areas.

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IV. DATA ANALYSIS

A. OVERVIEW

The data analysis section presents the data and calculations for both the status quo and the proposed alternative of establishing an ESD in Yuma. It shows what the actual and estimated biennial costs are in 2013 dollars for both situations, as well as the initial cost of construction for the alternative. It also displays the comparison of the two situations.

B. STATUS QUO COSTS

The data for the costs of the status quo comes from FY11 and FY12, during which four WTI exercises occurred. The relevant costs of the status quo include transportation costs, opportunity costs of time for both the equipment preparation and embarkation phase and the maintenance phase, and TAD costs.

1. Transportation Costs

The total transportation costs for FY 2011 and 2012 associated with equipment shipments to MCAS Yuma totaled $6,249,626. Due to the variability of operations and accounting measures at different units, some data were missing. Therefore, the total does not reflect all the transportation costs and the actual totals are higher. However, in keeping with the conservative approach of this research, the totals excluded some costs instead of trying to estimate them. This decreased the cost of the status quo as well as the potential savings of the alternative.

Table 6 shows the breakdown of costs by Marine Air-Ground Task Force (MAGTF) element per fiscal year. The Air Combat Element (ACE) accounted for a majority of the costs since it sends the most units to Yuma to train. These costs are highly correlated with fuel prices and will rise as fuel prices rise.

The transportation costs associated with the ACE included those of ground assets, not aviation assets. Aviation assets would continue to be the same in both situations and are not a relevant cost.

	FY11	FY12	Total
Air Combat Element	$ 2,319,656	$ 2,727,055	$ 5,046,711
Ground Combat Element	$ 214,034	$ 965,764	$ 1,179,798
Logistics Combat Element	$ 23,117	$ -	$ 23,117
Total	$ 2,556,807	$ 3,692,819	$ 6,249,626

Table 6 Transportation Costs Associated with the Status Quo

2. Cost of Time—Equipment Preparation and Embarkation Phase

The opportunity cost of time associated with the current operations' Equipment Preparation and Embarkation Phase represented a significant cost at all three levels of personnel involvement. By establishing the ESD, unit commanders can redirect personnel resources to other pressing matters instead of investing a large amount of personnel in the preparation and embarkation of equipment, an opportunity cost. Table 7 shows the opportunity costs of time at each level of involvement.

Personnel Involvement Level	10%	20%	30%
Total Biennial Cost	$ 5,521,041	$ 12,147,780	$ 18,407,966
Note: Calculated using Personnel Involvement (Table 2) times Daily Compensation Rate (Table 3) times 28 (Assumption regarding equipment prep and shipping)			

Table 7 Opportunity Cost of Time for Equipment Preparation and Embarkation Phase for the Status Quo

3. Cost of Time—Post-exercise Equipment Maintenance Phase

The opportunity cost of time associated with the Maintenance Phase of the current operations was less than that of the Equipment Preparation and Embarkation Phase, but still significant. These numbers represent a conservative cost estimate since the maintenance timeline assumption was ten days. In reality, the maintenance time could be greater, increasing these estimates. Establishing an ESD allows unit commanders to invest their maintenance personnel resources into fixing their own equipment, helping to increase the readiness percentage of the unit's equipment. Table 8 shows the opportunity cost of time during the post exercise maintenance phase at each level of involvement.

Personnel Involvement Level	10%	20%	30%
Total Biennial Cost	$ 1,971,800	$4,338,493	$6,574,274
Note: Calculated using Personnel Involvement (Table 2) times Daily Compensation Rate (Table 3) times 10 (Assumption regarding post-exercise equipment maintenance)			

Table 8 Opportunity Cost of Time for Post-Exercise Equipment Maintenance Phase for the Status Quo

4. Temporary Additional Duty Costs

The total Temporary Additional Duty (TAD) cost for the status quo is $29,016 per unit. Given there are nine units requiring TAD, the total TAD cost per WTI exercise is $261,144. The total biennial WTI cost is $1,044,576 as shown in Table 9.

Grade	Number of Given Grade	Days ADVON	Days Rear	Total Days TAD	TAD Cost/Day	TAD Cost
O - 3	1	10	3	13	$ 124	$ 1,612
O - 2	1	10	3	13	$ 124	$ 1,612
E - 7	1	10	3	13	$ 124	$ 1,612
E - 6	1	10	3	13	$ 124	$ 1,612
E - 5	2	10	3	13	$ 124	$ 3,224
E - 4	4	10	3	13	$ 124	$ 6,448
E - 3	8	10	3	13	$ 124	$ 12,896
Total per Unit	18			Total TAD Cost per unit		$ 29,016
					Total Cost per WTI exercise	$261,144
					Total Biennial Cost (4 WTI Exercises)	$1,044,576
Units requiring TAD include MACG HQ, MTACS, MASS, MWCS, MACS, LAAD, Inf Bln, Arty Bln, MWSS						

Table 9 Status Quo TAD Costs

C. PROPOSED ALTERNATIVE COSTS

The estimates for the costs of the alternative stem from actual costs of similar facilities and activities as well as DoD defined estimation tools. The relevant costs of the proposed alternative include the cost of permanent military and civilian personnel, facilities construction and annual operating costs, and TAD costs.

1. Permanent Personnel (Civilian and Military)

Based on the proposed personnel structure outlined in Figure 1 on page 21, the total biennial costs are $5,869,758 for permanent civilian personnel and $5,977,748 for permanent military personnel, making the grand total biennial cost of permanent civilian and military personnel $11,847,506. Table 10 depicts this information.

Personnel Type	Biennial Cost
Civilian	$ 5,869,758
Permanent Military	$ 5,977,748
Total Cost	$ 11,847,506
Note: Calculated using Proposed Org Chart (Figure 1) times Military Annual Compensation Rate (Table 3) or Annual GS Salaries (Table 5). For actual ranks and pay grades, see Appendix D. ESD Personnel Calculations.	

Table 10 Total Biennial Cost of Permanent Civilian and Military Personnel

2. Facilities Costs (Initial Construction and Annual Operating Costs)

The proposed alternative requires an estimated $18.6 million in initial construction costs. This is based on the costs of similar facilities built in Twentynine Palms. Yuma would not require the same space as Twenty-nine since it requires less equipment and holds fewer exercises. This means the construction cost could be lower, but, in keeping with the conservative approach of this research, the facilities cost calculations included the larger cost. The estimated biennial operating cost would be $840,6400. Table 11 shows both the estimated initial construction costs and the estimated biennial operating costs.

Estimated Size of Facility (in sqft)	Estimated Construction Costs*	Estimated 2013 Annual Operating Costs per sqft**	Total Estimated Annual Operating Costs	Total Estimated Biennial Operating Costs
74,000	$ 18,500,000	$ 5.68	$ 420,320	$ 840,640
Note 1: *Calculated using http://www.bls.gov/data/inflation_calculator.htm and conservatively rounded to nearest X.X million dollars. See Appendix C Note 2: **From FY 2010 Federal Real Property Report (Federal Real Property Council, 2010)				

Table 11 Facilities' Costs

3. Temporary Additional Duty Costs

As mentioned before, Temporary Additional Duty (TAD) costs exist in both situations, but the total costs differ due to the shortened amount of time the ADVON and rear party would be in Yuma. The total biennial TAD cost for the proposed alternative is $803,520 as reflected in Table 12.

Grade	Number of Given Grade	Days ADV ON	Days Rear	Total Days TAD	TAD Cost/Day	TAD Cost
O - 3	1	7	3	10	$ 124	$ 1,240
O - 2	1	7	3	10	$ 124	$ 1,240
E - 7	1	7	3	10	$ 124	$ 1,240
E - 6	1	7	3	10	$ 124	$ 1,240
E - 5	2	7	3	10	$ 124	$ 2,480
E - 4	4	7	3	10	$ 124	$ 4,960
E - 3	8	7	3	10	$ 124	$ 9,920
Total per Unit	18	Total TAD Cost per unit				$ 22,320
Total Cost per WTI exercise						$200,880
Total Biennial Cost (4 WTI Exercises)						$803,520
Units requiring TAD include MACG HQ, MTACS, MASS, MWCS, MACS, LAAD, Inf Bln, Arty Bln, MWSS						

Table 12 Proposed Alternative TAD Costs

D. COMPARATIVE ANALYSIS

Potential savings do exist when comparing the current operations to those of the proposed ESD. Table 13 shows the total biennial costs of the status quo and Table 14 shows those of the proposed alternative.

	10% Assumption	20% Assumption	30% Assumption
Current Operations	$ 23,324,459	$ 41,311,321	$ 58,303,257
Note: Summation of Tables 6–9.			

Table 13 Total Biennial Costs of the Status

	Annual Cost (O&M Funds)	Construction Costs (MILCON Funds)
Proposed Alternative	$ 13,491,666	$ 18,500,000
Note: Summation of Tables 10–12.		

Table 14 Total Biennial Costs the Proposed Alternative

Table 15 presents the potential biennial savings of establishing an ESD in Yuma as well as average annual savings, which are used in the NPV analysis. The average annual savings are derived by dividing the Total Biennial Savings by two.

	10% assumption	20% assumption	30% assumption
Total Biennial Savings	$ 9,832,793	$ 27,819,656	$ 44,811,592
Average Annual Savings	$ 4,916,397	$ 13,909,828	$ 22,405,796

Table 15 Expected Savings of Proposed Alternative

Over a two-year period, the potential savings range from $9.8 million to $44.8 million. The largest portion of savings comes from the opportunity cost of time. Establishing the ESD allows units to focus more time and resources on important endeavors other than preparing to ship and maintain equipment. More maintenance personnel resource availability coupled with the fact a unit is not using its own equipment increases the readiness percentage of the unit.

The foregone shipping costs also represent a large cost savings to O&M funds, allowing MSCs to prioritize funds to other operations and training exercises. Fuel prices have steadily risen over the past decade and that trend is not expected to change. Therefore, eliminating the transportation of equipment reduces the risk to the government associated with increasing fuel prices. Commanders would not have to choose between sending equipment and saving money.

E. NET PRESENT VALUE ANALYSIS

Using the net present value (NPV) method to discount the annual savings over a 50-year period, the implementation of the alternative could save the Marine Corps between $107,997,722 and $557,995,843, depending on the personnel involvement

assumption. Table 16 shows the savings comparison at the three personnel involvement levels.

Discount Factor per OMB	3.0%
Personnel Involvement Assumption Level	NPV
10%	$ 107,997,722
20%	$ 339,396,588
30%	$ 557,995,843

Table 16 NPV at Each Level of Participation Assuming 50-year Building Lifespan

F. SENSITIVITY ANALYSIS

The sensitivity analysis changed the life span assumption to 10 years, 15 years, and 20 years, which changes the discount rate to 2.0%, 2.4% and 2.7%, respectively. Table 17, Table 18, and Table 19 show the comparison of savings at the three levels of personnel participation for the 10-year, 15-year, and 20-year building lifespan assumptions, respectively.

Discount Factor per OMB	2.0%
Personnel Involvement Assumption Level	NPV
10%	$ 25,661,950
20%	$ 106,446,211
30%	$ 182,761,967

Table 17 NPV at Each Level of Participation Assuming 10-year Building Lifespan

Discount Factor per OMB	2.4%
Personnel Involvement Assumption Level	NPV
10%	$ 43,048,882
20%	$ 155,638,590
30%	$ 262,000,504

Table 18 NPV at Each Level of Participation Assuming 15-year Building Lifespan

Discount Factor per OMB	2.7%
Personnel Involvement Assumption Level	NPV
10%	$ 56,714,218
20%	$ 194,301,555
30%	$ 324,278,378

Table 19 NPV at Each Level of Participation Assuming 20-year Building Lifespan

As shown in the Tables 16–18, the potential cost savings decrease as the building lifespan assumption decreases. After conducting the sensitivity analysis, the lower-end of the range of savings changes from $107,997,722 (50-year assumption) to $25,661,950 (10-year assumption), while the upper-end remains $557,995,843 (50-year assumption). The sensitivity analysis shows a significant amount of potential savings.

G. SUMMARY

This chapter presented the quantified costs of the current operations and those of the proposed alternative, and compared them to evaluate the cost savings the Marine Corps could realize by establishing an ESD in Yuma, AZ. After combining the results of the sensitivity analysis with the results of the regular analysis, the Marine Corps could save between $25,661,950 (using the 10-year and 10% personnel involvement assumptions) and $557,995,843 (using the 50-year and 30% personnel involvement assumptions) by establishing an ESD in Yuma as opposed to shipping the equipment.

V. CONCLUSION

A. CONCLUSIONS

Overall, the establishment of an ESD in Yuma can save the Marine Corps money. The transportation and opportunity costs of time associated with the current operations cost the Corps money and decrease the efficiency of operations. The current operations require a large amount of resources from the MSCs, which could endanger the longevity of the operations in Yuma. By establishing an ESD, the Marine Corps saves money in the long run and makes the operations in Yuma more sustainable. By avoiding the transportation costs, the MSCs can save millions of dollars. It also allows units to spend time on more pressing issues rather than on equipment preparation.

While preparing the equipment for embarkation provides Marines with necessary training, it does not outweigh the cost of transporting that equipment across the country. Units can conduct embarkation training at their home base or station, reducing the costs while providing similar training.

The current fiscal situation necessitates the need for improving the efficiency of our operations, especially those vital training operations conducted on an annual basis. An ESD in Yuma allows the Marine Corps to continue the vital training exercises in the area, while allowing the MSCs to spend money on their own operations and training exercises instead of spending it on transporting equipment to Yuma.

B. RECOMMENDATIONS FOR FURTHER STUDY

This research focused on the costs associated with ground operations in Yuma and assumed all necessary equipment would be located at the ESD. While conducting this research, many issues were identified that necessitate further study. Specifically, this research suggests addressing the following questions:

1. Would it be more cost effective to increase the size and scope of the ESD in Twentynine Palms, CA, as opposed to establishing an ESD in Yuma?
2. Given the use of both high-and low-density equipment and expertise needed to maintain certain equipment, what is the most cost effective

equipment set that should be maintained at the Yuma ESD in order to maintain the current level of operations? As a corollary, is it more cost effective to continuing shipping in certain equipment items rather than maintaining them at the Yuma ESD?

3. Given a certain equipment set, what should the organization of the ESD be in order to maintain the necessary equipment at a relatively lower cost to the government?

4. Does the establishment of an ESD increase MCAS Yuma's capacity for conducting exercises? If so, by how much? Would conducting some exercises in Yuma instead of their current location save the Marine Corps money?

APPENDIX A. MILITARY PERSONNEL COMPENSATION TABLE

Military Personnel Compensation		
Rank	Annual Compensation	Daily Compensation
O - 10	$ 299,586.00	$ 1,315.18
O - 9	$ 300,234.00	$ 1,318.03
O - 8	$ 286,919.00	$ 1,259.57
O - 7	$ 256,047.00	$ 1,124.05
O - 6	$ 223,314.00	$ 980.35
O - 5	$ 188,914.00	$ 829.33
O - 4	$ 164,812.00	$ 723.52
O - 3	$ 138,563.00	$ 608.29
O - 2	$ 109,828.00	$ 482.14
O - 1	$ 82,056.00	$ 360.23
WO - 5	$ 179,786.00	$ 789.26
WO - 4	$ 158,076.00	$ 693.95
WO - 3	$ 137,667.00	$ 604.36
WO - 2	$ 121,662.00	$ 534.10
WO - 1	$ 110,497.00	$ 485.08
E - 9	$ 140,827.00	$ 618.23
E - 8	$ 115,976.00	$ 509.13
E - 7	$ 103,983.00	$ 456.49
E - 6	$ 90,139.00	$ 395.71
E - 5	$ 73,307.00	$ 321.82
E - 4	$ 60,214.00	$ 264.34
E - 3	$ 51,069.00	$ 224.19
E - 2	$ 45,373.00	$ 199.19
E - 1	$ 41,804.00	$ 183.52

*Using Composite Rates for Compensation

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APPENDIX B. CIVILIAN SALARY TABLE

GS Employee Salaries										
Grade	Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7	Step 8	Step 9	Step 10
1	$20,787	$21,482	$22,173	$22,860	$23,552	$23,958	$24,641	$25,330	$25,357	$26,001
2	23,372	23,928	24,701	25,357	25,642	26,396	27,150	27,904	28,659	29,413
3	25,500	26,350	27,200	28,050	28,900	29,750	30,600	31,450	32,300	33,150
4	28,627	29,581	30,535	31,489	32,443	33,397	34,351	35,305	36,259	37,213
5	32,028	33,096	34,163	35,230	36,297	37,364	38,432	39,499	40,566	41,633
6	35,702	36,891	38,081	39,271	40,461	41,651	42,840	44,030	45,220	46,410
7	39,674	40,997	42,320	43,643	44,965	46,288	47,611	48,934	50,257	51,580
8	43,938	45,402	46,866	48,330	49,795	51,259	52,723	54,187	55,651	57,115
9	48,529	50,146	51,763	53,380	54,997	56,615	58,232	59,849	61,466	63,083
10	53,442	55,224	57,006	58,787	60,569	62,351	64,133	65,915	67,696	69,478
11	58,715	60,672	62,629	64,586	66,543	68,500	70,456	72,413	74,370	76,327
12	70,376	72,722	75,067	77,413	79,759	82,104	84,450	86,796	89,142	91,487
13	83,687	86,476	89,265	92,055	94,844	97,634	100,423	103,212	106,002	108,791
14	98,892	102,188	105,484	108,781	112,077	115,373	118,669	121,965	125,261	128,557
15	116,326	120,203	124,081	127,958	131,836	135,714	139,591	143,469	147,346	151,224

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APPENDIX C. MILCON COST CALCULATIONS

BLDG*	Year Built*	SqFt*	Cost*	Cost in 2013 Dollars (BLS Website**)	2013 Rounded***
2044	1986	25,000	$ 3,400,000	$ 7,263,746	$ 7,300,000
2054	1986	30,000	$ 3,200,000	$ 6,836,467	$ 6,900,000
2061	2002	19,000	$ 3,300,000	$ 4,295,118	$ 4,300,000
			Total Initial Investment		$ 18,500,000

2010 Operating Costs/SqFt****	Estimated 2013 Annual Operating Costs/SqFt (BLS Website**)	Estimated Total Annual Operating Costs of Facilities
$ 5.30	$ 5.68	$ 142,000
$ 5.30	$ 5.68	$ 170,400
$ 5.30	$ 5.68	$ 107,920
Total Estimated Annual Operating Cost		$ 420,320

*BLDG, Year built, SqFt, and Cost data provided by Twentynine Palms G-4 PWD Planning Office

**Calculated using BLS CPI Inflation Calculator at http://www.bls.gov/data/inflation_calculator.htm

***Conservative assumption: Rounded everything up to X.X million dollars

****Operating Costs based on http://www.gsa.gov/graphics/ogp/FY_2010_FRPP_Report_Final.pdf

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APPENDIX D. ESD PERSONNEL CALCULATIONS

							Total	Mil	Civ
				Total Annual			$ 5,923,753	$ 2,988,874	$ 2,934,879
				Total Biennial			$11,847,506	$ 5,977,748	$ 5,869,758
					39	78	TOTALS	$ 2,988,874	$ 2,934,879
			Type	Paygrade	Mil	Civ	Annual Salary	Mil Salary	Civ Salary
HQ									
	OIC		Mil	O-4	1		$ 64,812	$ 164,812	
	XO/Hazmat		Civ	GS-10		1	$ 69,478		$ 69,478
Ops Branch									
	OIC		Mil	O-3	1		$ 138,563	$ 138,563	
	Ops Section								
		Ops Chief	Mil	E-7	1		$ 103,983	$ 103,983	
		Section	Civ	GS-4		2	$ 37,213		$ 74,426
	MMO Section								
		OIC		O-2	1		$ 109,828	$ 109,828	
		Chief		E-6	1				
		Section	Civ	GS-4		3	$ 37,213		$ 111,639
Materiel Readiness Branch									
	OIC		Mil	O-3	1		$ 138,563	$ 138,563	
	Supply								
		Supply Chief	Mil	E-6	1		$ 90,139	$ 90,139	
		Admin Section	Civ	GS-4		7	$ 37,213		$ 260,491
	Warehouse								
		Chief	Mil	E-6	1		$ 90,139	$ 90,139	
		Section	Civ	GS-4		9	$ 37,213		$ 334,917
MT/Eng Maint Branch									
	OIC		Mil	W-3	1		$ 137,667	$ 137,667	
	MT Section								
		Chief	Mil	E-7	1		$ 103,983	$ 103,983	
		Maint Section	Mil	E-4	16		$ 60,214	$ 963,424	
			Civ	GS-4		35	$ 37,213		$ 1,302,455
	Eng Section								
		Chief	Mil	E-7	1		$ 103,983	$ 103,983	
		Maint Section	Mil	E-4	5		$ 60,214	$ 301,070	
			Civ	GS-4		9	$ 37,213		$ 334,917
	Ordnance Maint Sect		Civ	GS-4		2	$ 37,213		$ 74,426
Comm Maint Branch									
	OIC		Mil	W-3	1		$ 137,667	$ 137,667	
	Chief		Mil	E-7	1		$ 103,983	$ 103,983	
	Maint Section		Mil	E-4	5		$ 60,214	$ 301,070	
			Civ	GS-4		10	$ 37,213		$ 372,130

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APPENDIX E. 50-YEAR NPV CALCULATION

	50-Year Assumption		Discount Rate	Personnel Level	**10%**	**20%**	**30%**
			3.0%	NPV	$107,997,722	$339,396,588	$557,995,843
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
10%	($18,500,000)	$4,773,200	$4,634,175	$4,499,199	$4,368,155	$4,240,927	$4,117,405
20%	($18,500,000)	$13,504,687	$13,111,347	$12,729,463	$12,358,702	$11,998,740	$11,649,262
30%	($18,500,000)	$21,753,200	$21,119,612	$20,504,477	$19,907,260	$19,327,436	$18,764,501
	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
10%	$3,997,480	$3,881,049	$3,768,009	$3,658,261	$3,551,709	$3,448,262	$3,347,827
20%	$11,309,963	$10,980,547	$10,660,725	$10,350,218	$10,048,756	$9,756,073	$9,471,916
30%	$18,217,963	$17,687,342	$17,172,177	$16,672,016	$16,186,424	$15,714,974	$15,257,257
	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
10%	$3,250,317	$3,155,648	$3,063,736	$2,974,501	$2,887,865	$2,803,752	$2,722,090
20%	$9,196,035	$8,928,189	$8,668,145	$8,415,675	$8,170,558	$7,932,580	$7,701,534
30%	$14,812,871	$14,381,428	$13,962,551	$13,555,875	$13,161,044	$12,777,712	$12,405,546
	Year 21	Year 22	Year 23	Year 24	Year 25	Year 26	Year 27
10%	$2,642,805	$2,565,830	$2,491,098	$2,418,541	$2,348,098	$2,279,707	$2,213,308
20%	$7,477,218	$7,259,435	$7,047,995	$6,842,714	$6,643,411	$6,449,914	$6,262,052
30%	$12,044,219	$11,693,417	$11,352,832	$11,022,167	$10,701,133	$10,389,449	$10,086,844

	50-Year Assumption		Discount Rate	Personnel Level	**10%**	**20%**	**30%**
			3.0%	NPV	$107,997,722	$339,396,588	$557,995,843
	Year 28	Year 29	Year 30	Year 31	Year 32	Year 33	Year 34
10%	$2,148,843	$2,086,255	$2,025,490	$1,966,495	$1,909,219	$1,853,611	$1,799,622
20%	$6,079,662	$5,902,585	$5,730,665	$5,563,752	$5,401,701	$5,244,370	$5,091,622
30%	$9,793,053	$9,507,818	$9,230,891	$8,962,030	$8,701,000	$8,447,573	$8,201,527
	Year 35	Year 36	Year 37	Year 38	Year 39	Year 40	Year 41
10%	$1,747,206	$1,696,316	$1,646,909	$1,598,941	$1,552,370	$1,507,155	$1,463,257
20%	$4,943,322	$4,799,342	$4,659,555	$4,523,840	$4,392,077	$4,264,153	$4,139,954
30%	$7,962,648	$7,730,726	$7,505,559	$7,286,951	$7,074,710	$6,868,650	$6,668,592
	Year 42	Year 43	Year 44	Year 45	Year 46	Year 47	Year 48
10%	$1,420,638	$1,379,260	$1,339,088	$1,300,085	$1,262,219	$1,225,455	$1,189,762
20%	$4,019,373	$3,902,304	$3,788,645	$3,678,296	$3,571,161	$3,467,147	$3,366,162
30%	$6,474,361	$6,285,788	$6,102,707	$5,924,958	$5,752,386	$5,584,841	$5,422,176
	Year 49	Year 50					
10%	$1,155,109	$1,121,465					
20%	$3,268,118	$3,172,930					
30%	$5,264,248	$5,110,921					

APPENDIX F. 20-YEAR NPV CALCULATION

	20-Year Assumption		Discount Rate	Personnel Level	10%	20%	30%
			2.7%	NPV	$ 56,714,218	$ 194,301,555	$ 324,278,378
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
10%	$(18,500,000)	$,787,144	$ 4,661,289	$ 4,538,743	$ 4,419,418	$ 4,303,231	$ 4,190,099
20%	$(18,500,000)	$ 3,544,136	$ 13,188,059	$12,841,342	$ 12,503,741	$ 12,175,016	$ 11,854,933
30%	$(18,500,000)	$21,816,744	$ 21,243,178	$20,684,691	$ 20,140,887	$ 19,611,380	$ 19,095,794
	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
10%	$ 4,079,940	$ 3,972,678	$ 3,868,236	$ 3,766,539	$ 3,667,516	$ 3,571,096	$ 3,477,212
20%	$ 11,543,265	$11,239,790	$ 10,944,294	$10,656,567	$ 10,376,404	$ 10,103,607	$ 9,837,981
30%	$ 18,593,762	$18,104,929	$ 17,628,948	$17,165,480	$ 16,714,196	$ 16,274,777	$ 15,846,911
	Year 14	Year 15	Year 16	Year 17	Year 18	Year 19	Year 20
10%	$ 3,385,795	$ 3,296,782	$ 3,210,109	$ 3,125,715	$ 3,043,539	$ 2,963,524	$ 2,885,613
20%	$ 9,579,339	$ 9,327,497	$ 9,082,275	$ 8,843,501	$ 8,611,004	$ 8,384,619	$ 8,164,186
30%	$ 15,430,293	$15,024,628	$ 14,629,628	$14,245,013	$ 13,870,509	$ 13,505,851	$ 13,150,780

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APPENDIX G. 15-YEAR NPV CALCULATION

	15-Year Assumption		Discount Rate	Personnel Level	10%	20%	30%
			2.4%	NPV	$43,048,882	$155,638,590	$262,000,504
	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
10%	$(18,500,000)	$ 4,803,514	$ 4,693,223	$ 4,585,465	$ 4,480,181	$ 4,377,314	$ 4,276,809
20%	$(18,500,000)	$13,590,452	$13,278,410	$ 12,973,532	$12,675,654	$ 12,384,615	$ 12,100,259
30%	$(18,500,000)	$21,891,349	$21,388,714	$ 20,897,620	$20,417,802	$ 19,949,001	$ 19,490,963
	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13
10%	$ 4,178,611	$ 4,082,669	$ 3,988,929	$ 3,897,341	$ 3,807,857	$ 3,720,427	$ 3,635,004
20%	$ 11,822,432	$11,550,984	$11,285,768	$ 11,026,642	$10,773,466	$ 10,526,102	$ 10,284,419
30%	$ 19,043,442	$18,606,196	$18,178,990	$ 17,761,593	$17,353,779	$ 16,955,329	$ 16,566,027
	Year 14	Year 15					
10%	$ 3,551,543	$ 3,469,998					
20%	$ 10,048,284	$ 9,817,571					
30%	$ 16,185,664	$15,814,034					

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APPENDIX H. 10-YEAR NPV CALCULATION

10-Year Assumption		Discount Rate	Personnel Level	10%	20%	30%
		2.0%	NPV	$ 25,661,950	$106,446,211	$182,761,967
Year 0	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6
$(18,500,000)	$ 4,819,997	$ 4,725,487	$ 4,632,830	$ 4,541,990	$ 4,452,932	$ 4,365,619
$(18,500,000)	$ 13,637,086	$ 13,369,692	$ 13,107,541	$ 12,850,531	$ 12,598,560	$ 12,351,529
$(18,500,000)	$ 21,966,467	$ 21,535,752	$ 21,113,482	$ 20,699,492	$ 20,293,620	$ 19,895,706
Year 7	Year 8	Year 9	Year 10			
$ 4,280,019	$ 4,196,097	$ 4,113,821	$ 4,033,158			
$ 12,109,342	$ 11,871,904	$ 11,639,122	$ 11,410,904			
$ 19,505,594	$ 19,123,131	$ 18,748,168	$ 18,380,557			

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LIST OF REFERENCES

The Bureau of Labor Statistics (2013). CPI inflation calculator. Retrieved from http://www.bls.gov/data/inflation_calculator.htm

Department of Energy (2013). *Buildings energy data book*. Retrieved from http://buildingsdatabook.eren.doe.gov/CBECS.aspx

Department of the Treasury. (2013, January 16). Historical debt outstanding—annual 2000–2012. Retrieved from http://www.treasurydirect.gov/govt/reports/pd/histdebt/histdebt_histo5.htm

Deputy Comptroller. (2012, April 9). *FY 2013 Department of Defense (DoD) military personnel composite standard pay and reimbursement rates* [Memorandum]. Washington, DC: Office of the Under Secretary of Defense (Comptroller).

Federal Real Property Council. (2010). *FY 2010 Federal Real Property Report: An Overview of the U.S. Federal Government's Real Property Assets*. Washington, DC: General Services Administration. Retrieved from http://www.gsa.gov/graphics/ogp/FY_2010_FRPP_Report_Final.pdf

Federal Real Property Council. (2012, October 25). *2012 Guidance for real property inventory reporting*. Washington, DC: General Services Administration. Retrieved from http://www.gsa.gov/portal/content/103101

Garrison, R. H., Noreen, E. W., & Brewer, P. C. (2012). *Managerial accounting* (14th ed.). New York, NY: McGraw-Hill

Hinman, A. R. (2011, December 14). *Analysis of the potential efficiencies gained from a permanent maintenance detachment at NAF El Centro, California* (Master's thesis). Retrieved from https://dklsp.ern.nps.edu/npslimdist/NPSColl_Theses/03/11Dec_Hinman_MBA.pdf

Jovanovic, P. (1999). Application of sensitivity analysis in investment project evaluation under uncertainty and risk. *International Journal of Project Management, 17*(4), 217–222. Retrieved from http://sedok.narod.ru/s_files/poland/32.pdf

Marine Corps Air Station Yuma. (1997). History of MCAS Yuma. Retrieved from http://www.mcasyuma.marines.mil/About/History.aspx

Marine Aviation Weapons and Tactics Squadron One (MAWTS-1). (1995). History of MAWTS-1. Retrieved from https://www.trngcmd.usmc.mil/mawts1/Web%20Pages/Suqadron-History.aspx

Marine Aviation Weapons and Tactics Squadron 1 (MAWTS-1). (2012, December 14). *WTI 2-13 planning guide: Conference results and course requirements*. Retrieved from https://vcepub.tecom.usmc.mil/sites/msc/magtftc/mawts1/WTI/default.aspx

Office of Management and Budget (2013). 2013 Discount Rates for OMB Circular No. A-94. Retrieved from http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c

Office of Personnel Management (OPM). (2013). Salary table 2013-PX incorporating a locality payment of 16.67% for the locality pay area of Phoenix-Mesa-Scottsdale, AZ rates frozen at 2010 levels. Retrieved from http://www.opm.gov/policy-data-oversight/pay-leave/salaries-wages/2013/general-schedule/

Office of the Under Secretary of Defense (Comptroller). (2012). More disciplined use of resources. Retrieved from http://comptroller.defense.gov/defbudget/fy2013/fy2013_Efficiency_Justification_Book.pdf

Pellerin, C. (2012, September 20). Comptroller: Sequestration would devastate defense spending. *American Forces Press Service*. Retrieved from http://www.defense.gov/News/NewsArticle.aspx?ID=117949

United States Marine Corps (2012). Precedence levels for manning and staffing. Retrieved from http://community.marines.mil/news/publications/Documents/MCO%205320_12H.pdf

United States Navy (2013). Comparison of Military and Civilian Equivalent Grades. Retrieved from http://www.history.navy.mil/library/online/comparison.htm

The White House. (2013). The sequester. Retrieved from http://www.whitehouse.gov/issues/sequester

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